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(54) Title: SYSTEMS AND METHODS FOR SECURE TRANSACTION MANAGEMENT AND ELECTRONIC RIGHTS PROTECTION

(57) Abstract

The present invention provides systems and methods for electronic commerce including secure transaction management and electronic rights protection. Electronic appliances such as computers employed in accordance with the present invention help to ensure that information is accessed and used only in authorized ways, and maintain the integrity, availability, and/or confidentiality of the information. Secure subsystems used with such electronic appliances provide a distributed virtual distribution environment (VDE) that may enforce a secure chain of handling and control, for example, to control and/or meter or otherwise monitor use of electronically stored or disseminated information. Such a virtual distribution environment may be used to protect rights of various participants in electronic commerce and other electronic or electronic-facilitated transactions. Secure distributed and other operating system environments and architectures, employing, for example, secure semiconductor processing arrangements that may establish secure, protected environments at each node. These techniques may be used to support an end-to-end electronic information distribution capability that may be used, for example, utilizing the "electronic highway".

MORE DETAILED DESCRIPTION

Figures 1-7 and the discussion below provides an overview of some aspects of features provided by this invention. Following this overview is a more technical "detail description" of example embodiments in accordance with the invention.

Overview

Figure 1 shows a "Virtual Distribution Environment" ("VDE") 100 that may be provided in accordance with this invention. In Figure 1, an information utility 200 connects to communications means 202 such as telephone or cable TV lines for example. Telephone or cable TV lines 202 may be part of an "electronic highway" that carries electronic information from place to place. Lines 202 connect information utility 200 to other people

such as for example a consumer 208, an office 210, a video production studio 204, and a publishing house 214. Each of the people connected to information utility 200 may be called a "VDE participant" because they can participate in transactions occurring within the virtual distribution environment 100.

Almost any sort of transaction you can think of can be supported by virtual distribution environment 100. A few of many examples of transactions that can be supported by virtual distribution environment 100 include:

- C home banking and electronic payments;
- C electronic legal contracts;
- C distribution of "content" such as electronic printed matter, video, audio, images and computer programs; and
- C secure communication of private information such as medical records and financial information.

Virtual distribution environment 100 is "virtual" because it does not require many of the physical "things" that used to be necessary to protect rights, ensure reliable and predictable distribution, and ensure proper compensation to content creators and distributors. For example, in the past, information was

Figure 8 shows that secondary storage 652 may also be used to store code ("application programs") providing user application(s) 608 shown in Figure 7. Figure 8 shows that there may be two general types of application programs 608: "VDE aware" applications 608a, and Non-VDE aware applications 608b. VDE aware applications 608a may have been at least in part designed specifically with VDE 100 in mind to access and take detailed advantage of VDE functions 604. Because of the "transparency" features of ROS 602, non-VDE aware applications 608b (e.g., applications not specifically designed for VDE 100) can also access and take advantage of VDE functions 604.

SECURE PROCESSING UNIT 500

Each VDE node or other electronic appliance 600 in the preferred embodiment may include one or more SPUs 500. SPUs 500 may be used to perform all secure processing for VDE 100. For example, SPU 500 is used for decrypting (or otherwise unsecuring) VDE protected objects 300. It is also used for managing encrypted and/or otherwise secured communication (such as by employing authentication and/or error-correction validation of information). SPU 500 may also perform secure data management processes including governing usage of,

auditing of, and where appropriate, payment for VDE objects 300 (through the use of prepayments, credits, real-time electronic debits from bank accounts and/or VDE node currency token deposit accounts). SPU 500 may perform other transactions related to such VDE objects 300.

SPU Physical Packaging and Security Barrier 502

As shown Figure 6, in the preferred embodiment, an SPU 500 may be implemented as a single integrated circuit "chip" 505 to provide a secure processing environment in which confidential and/or commercially valuable information can be safely processed, encrypted and/or decrypted. IC chip 505 may, for example, comprise a small semiconductor "die" about the size of a thumbnail. This semiconductor die may include semiconductor and metal conductive pathways. These pathways define the circuitry, and thus the functionality, of SPU 500. Some of these pathways are electrically connected to the external "pins" 504 of the chip 505.

As shown in Figures 6 and 9, SPU 500 may be surrounded by a tamper-resistant hardware security barrier 502. Part of this security barrier 502 is formed by a plastic or other package in

which an SPU "die" is encased. Because the processing occurring within, and information stored by, SPU 500 are not easily accessible to the outside world, they are relatively secure from unauthorized access and tampering. All signals cross barrier 502 through a secure, controlled path provided by BIU 530 that restricts the outside world's access to the internal components within SPU 500. This secure, controlled path resists attempts from the outside world to access secret information and resources within SPU 500.

It is possible to remove the plastic package of an IC chip and gain access to the "die." It is also possible to analyze and "reverse engineer" the "die" itself (e.g., using various types of logic analyzers and microprobes to collect and analyze signals on the die while the circuitry is operating, using acid etching or other techniques to remove semiconductor layers to expose other layers, viewing and photographing the die using an electron microscope, etc.) Although no system or circuit is absolutely impervious to such attacks, SPU barrier 502 may include additional hardware protections that make successful attacks exceedingly costly and time consuming. For example, ion implantation and/or other fabrication techniques may be used to

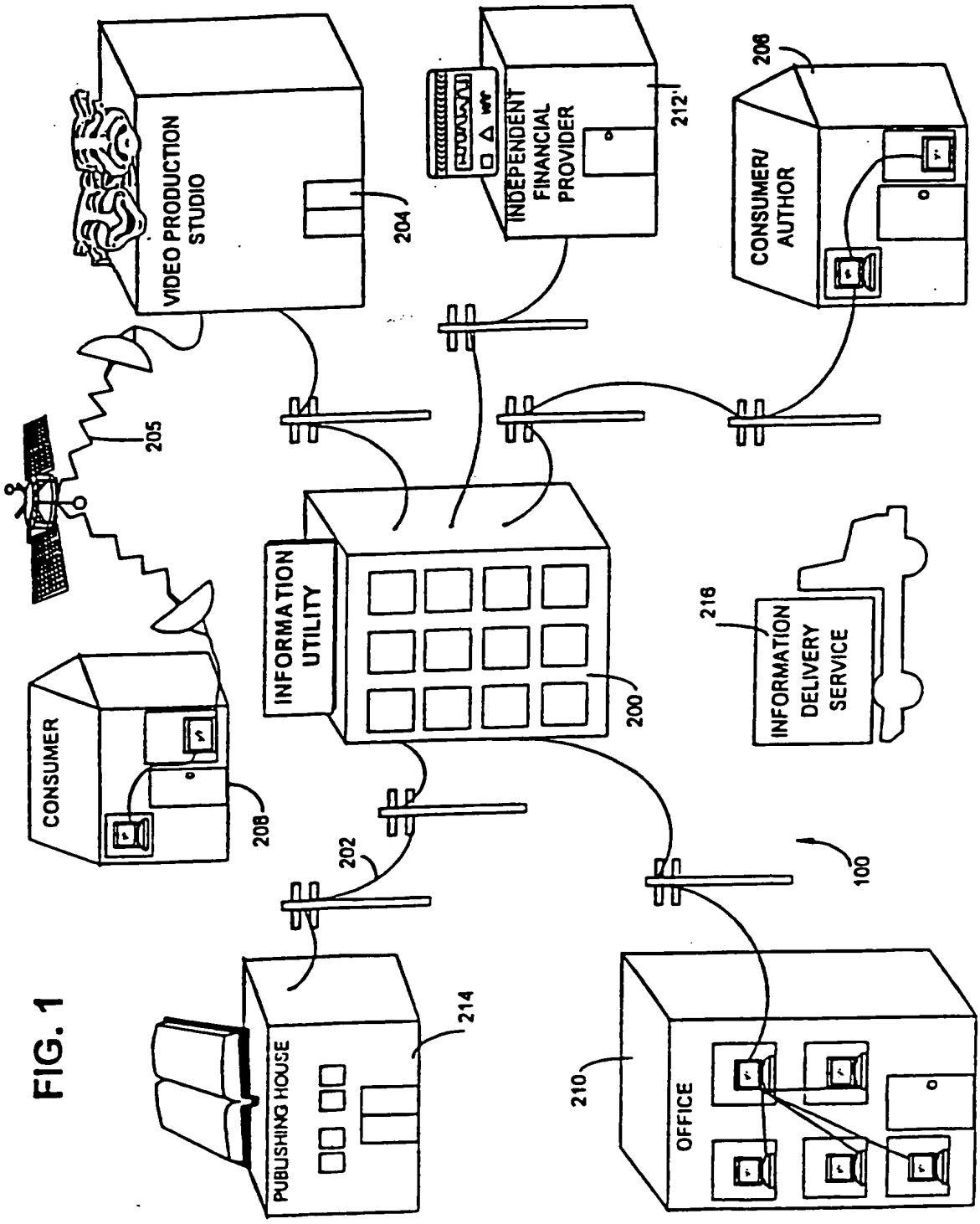
VIDEO PRODUCTION STUDIO
204
INDEPENDENT FINANCIAL PROVIDER
212
206
CONSUMER/ AUTHOR
205
INFORMATION UTILITY
200
216
INFORMATION DELIVERY SERVICE
CONSUMER
208
202
100
PUBLISHING HOUSE
214
210
OFFICE

FIG. 1

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FIG. 6

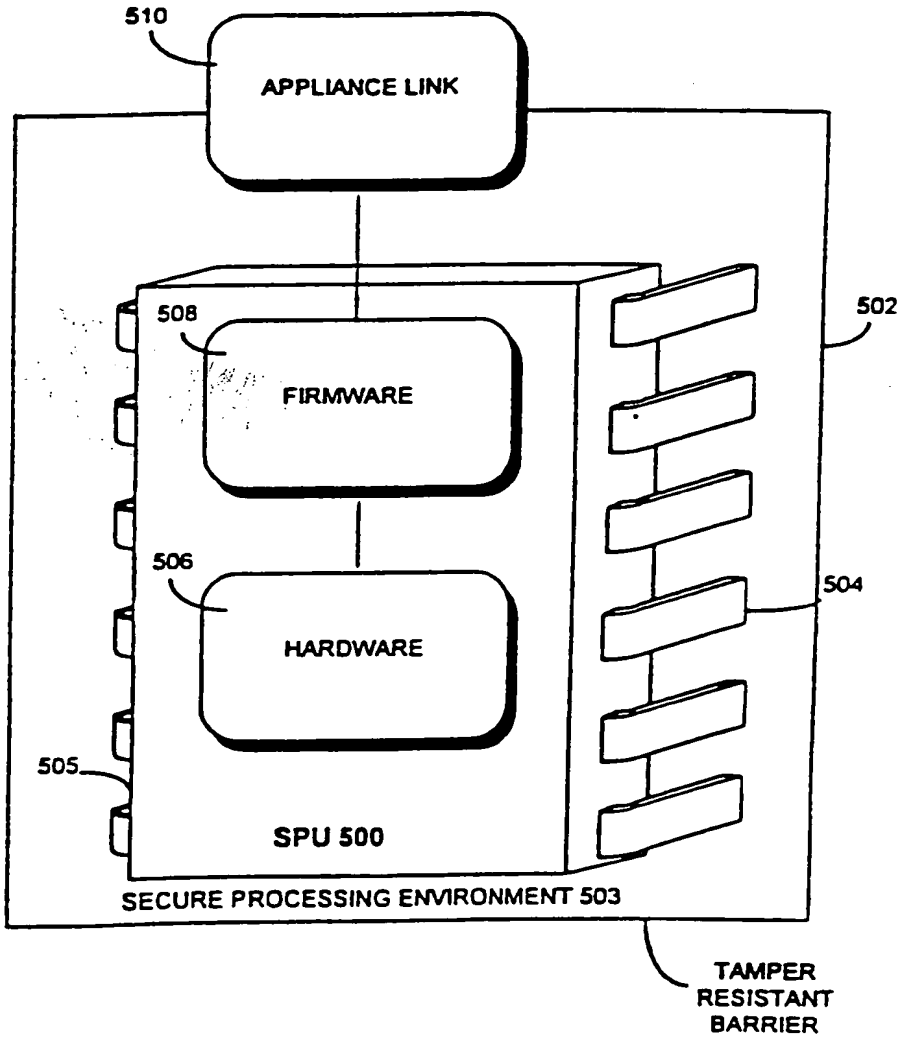
510
APPLIANCE LINK
508
FIRMWARE
506
HARDWARE
505
SPU 500
502
504
SECURE PROCESSING ENVIRONMENT 503
TAMPER RESISTANT BARRIER

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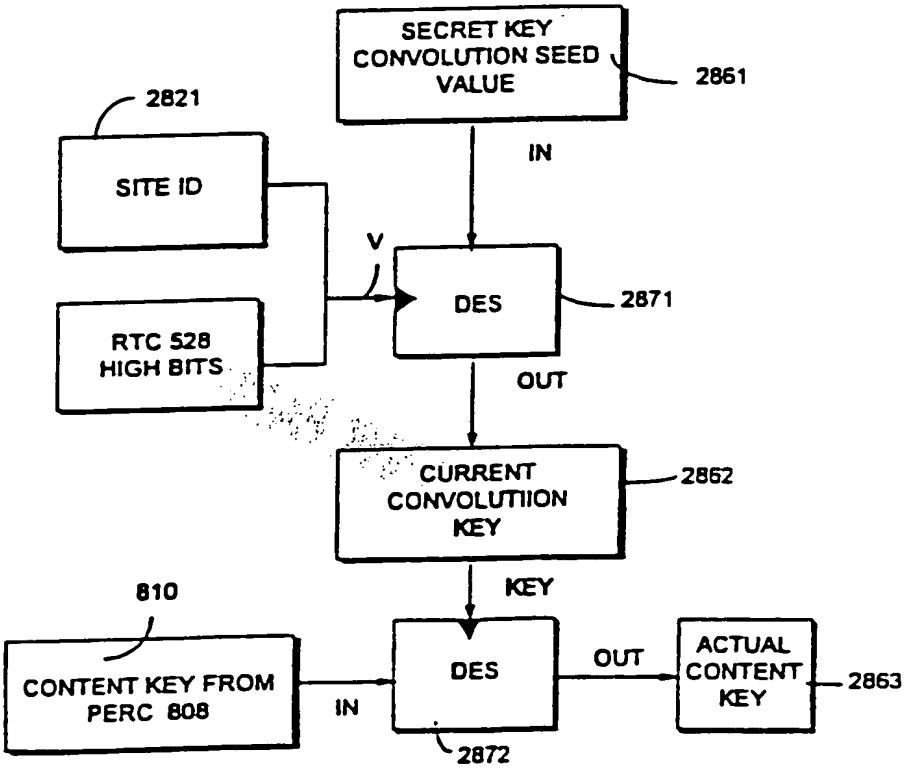
FIG. 62

KEY CONVOLUTION PROCESS



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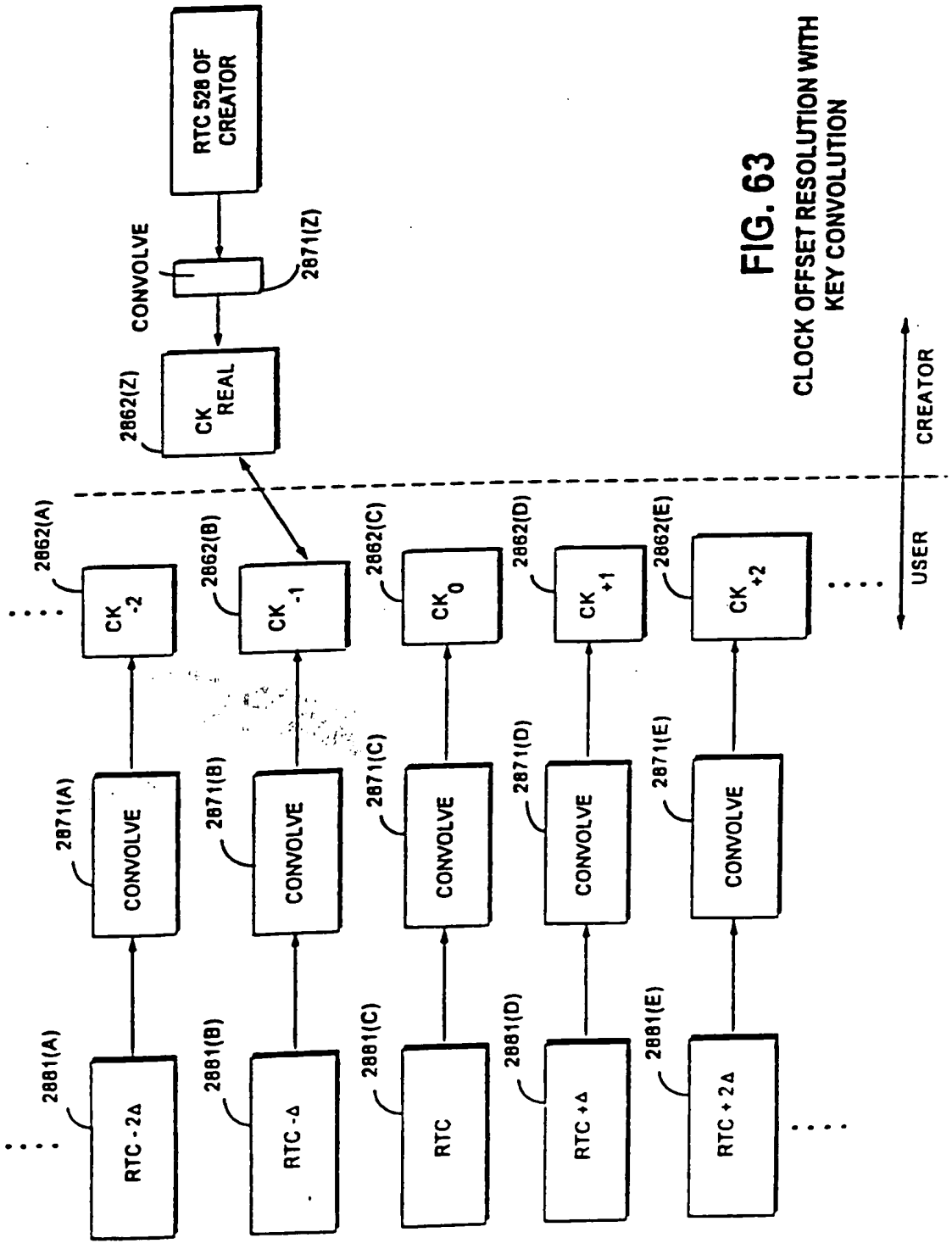

FIG. 63
CLOCK OFFSET RESOLUTION WITH KEY CONVOLUTION

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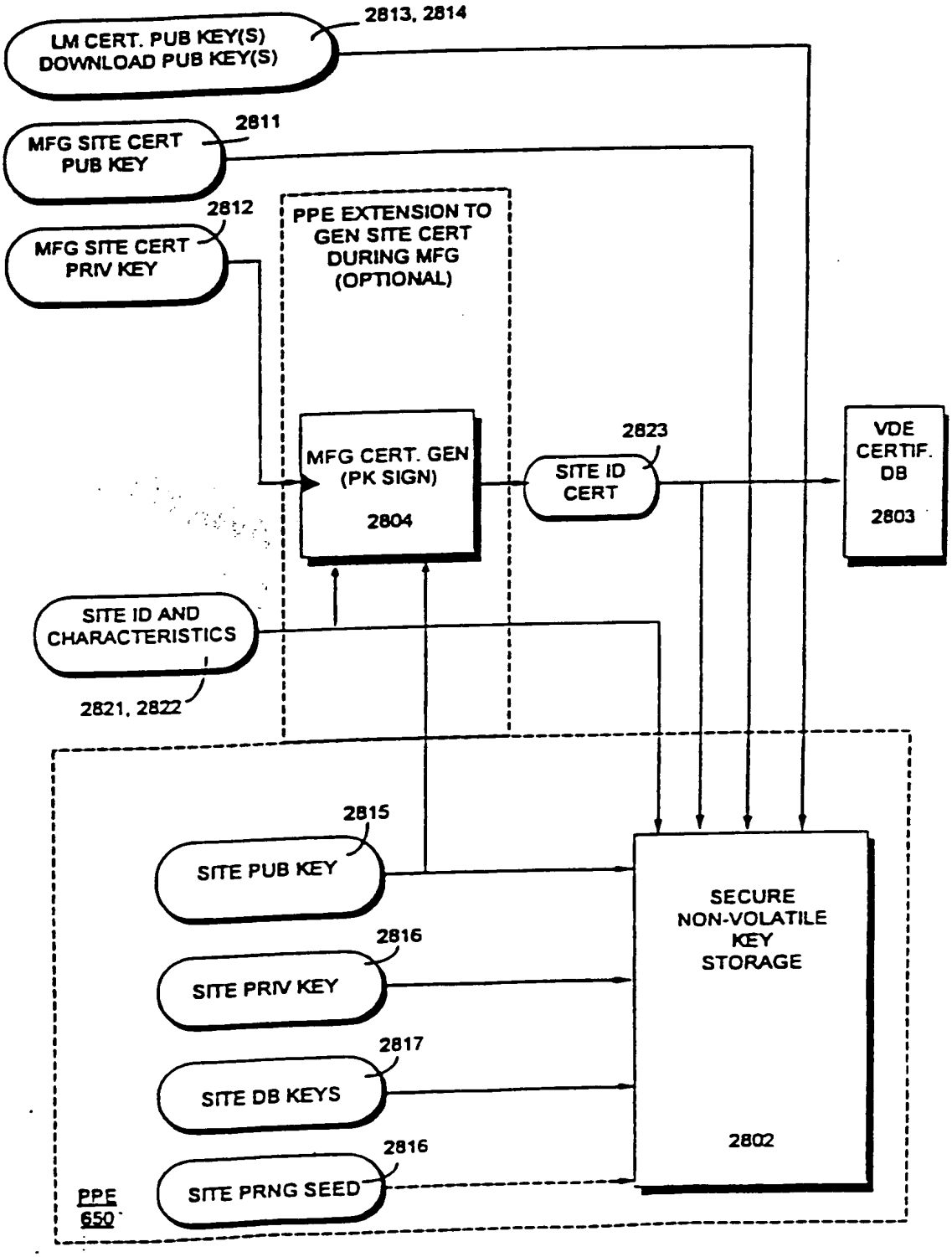
FIG. 64 SPU KEY INITIALIZATION/INSTALLATION



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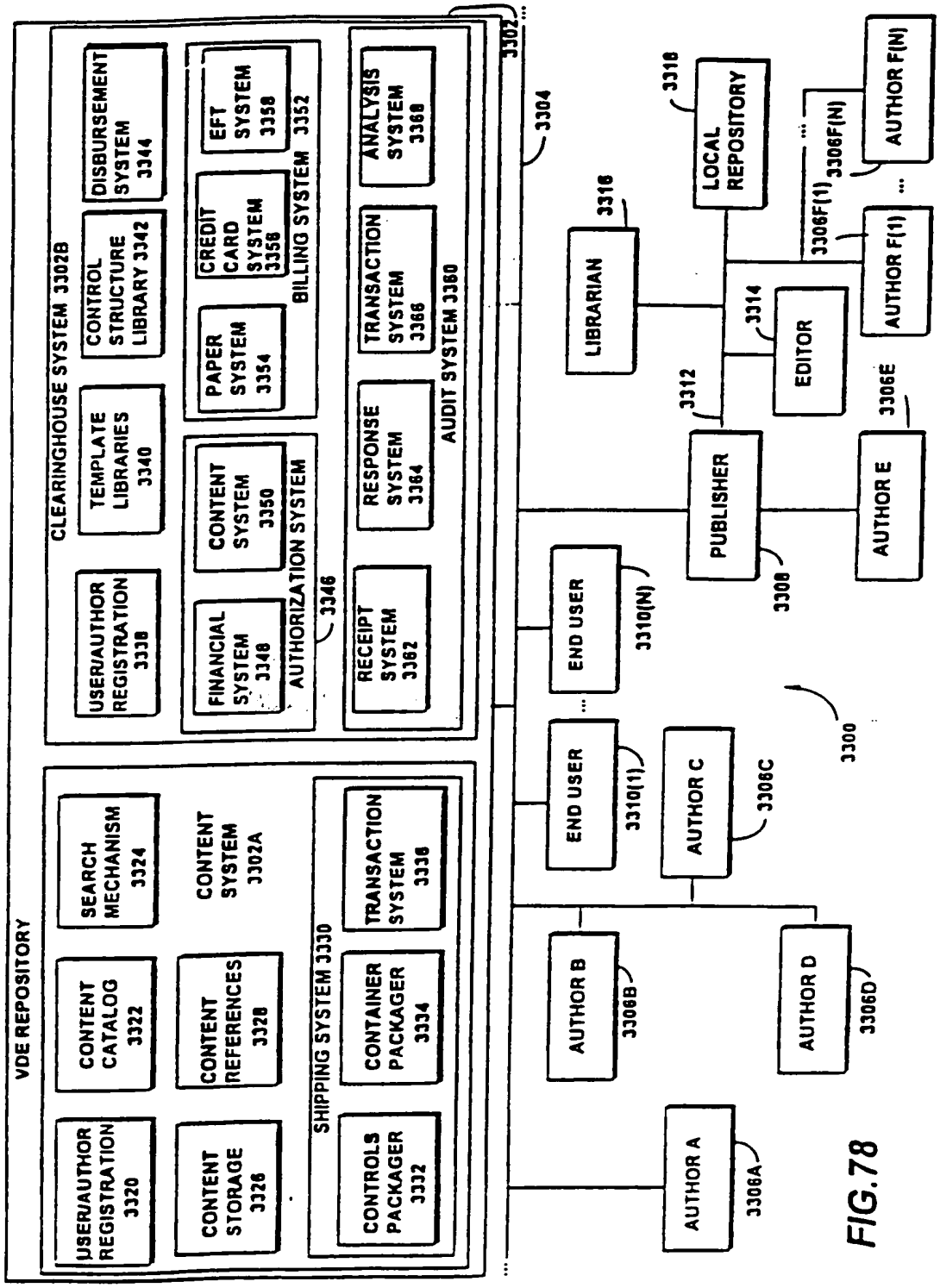
VDE REPOSITORY
USER/AUTHOR REGISTRATION 3320
CONTENT CATALOG 3322
SEARCH MECHANISM 3324
CONTENT STORAGE 3326
CONTENT REFERENCES 3328
CONTENT SYSTEM 3302A
SHIPPING SYSTEM 3330
CONTROLS PACKAGER 3332
CONTAINER PACKAGER 3334
TRANSACTION SYSTEM 3336
CLEARINGHOUSE SYSTEM 3302B
USER/AUTHOR REGISTRATION 3338
TEMPLATE LIBRARIES 3340
CONTROL STRUCTURE LIBRARY 3342
DISBURSEMENT SYSTEM 3344
AUTHORIZATION SYSTEM 3346
FINANCIAL SYSTEM 3348
CONTENT SYSTEM 3350
BILLING SYSTEM 3352
PAPER SYSTEM 3354
CREDIT CARD SYSTEM 3356
EFT SYSTEM 3358
AUDIT SYSTEM 3360
RECEIPT SYSTEM 3362
RESPONSE SYSTEM 3364
TRANSACTION SYSTEM 3366
ANALYSIS SYSTEM 3368
3302
3304
3300
AUTHOR A 3306A
AUTHOR B 3306B
AUTHOR C 3306C
AUTHOR D 3306D
AUTHOR E 3306E
AUTHOR F(1) 3306F(1)
AUTHOR F(N) 3306F(N)
END USER 3310(1)
END USER 3310(N)
PUBLISHER 3308
EDITOR 3314
LIBRARIAN 3316
LOCAL REPOSITORY 3318
3312

FIG.78

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FIG. 79

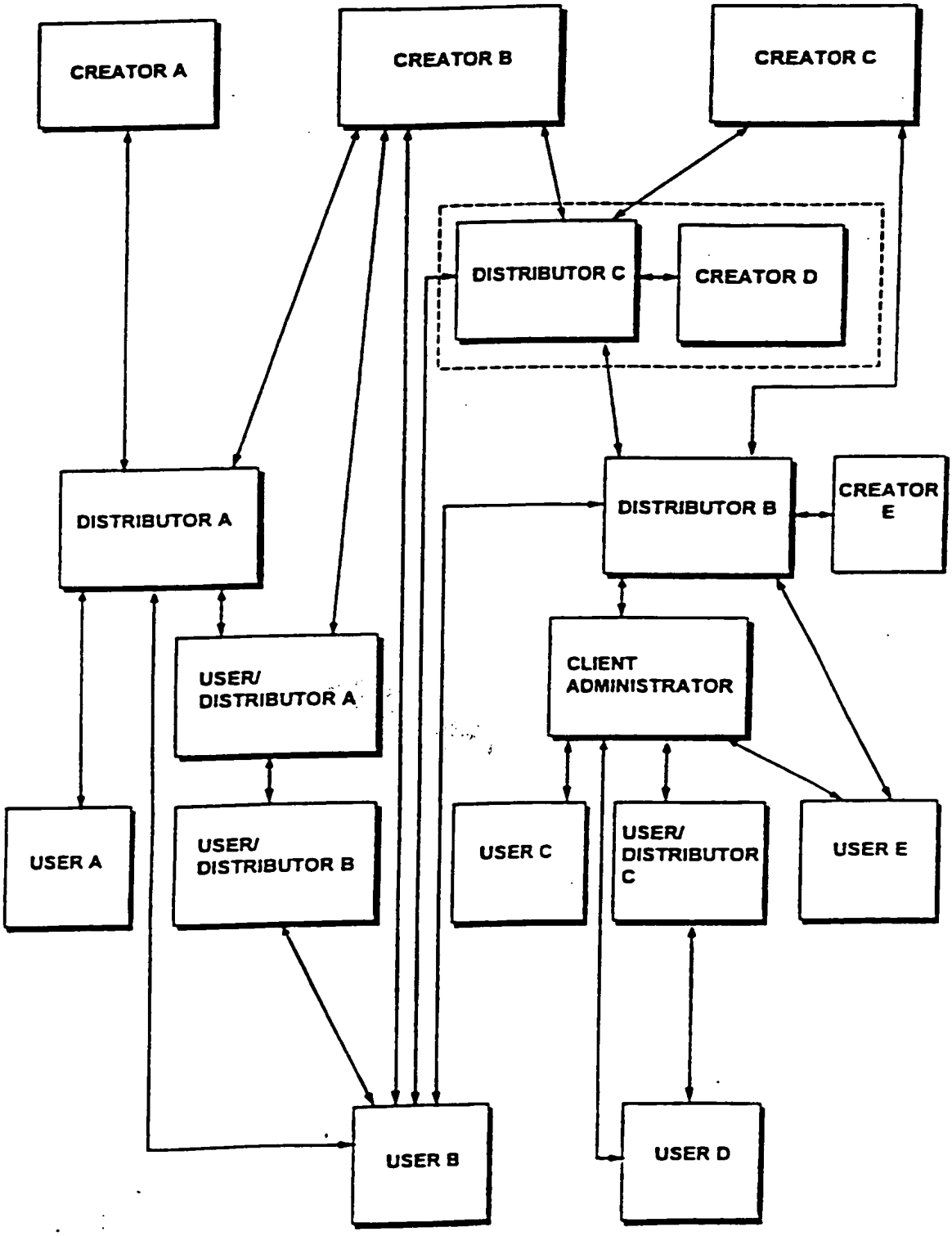
CREATOR A
CREATOR B
CREATOR C
DISTRIBUTOR C
CREATOR D
DISTRIBUTOR A
DISTRIBUTOR B
CREATOR E
USER/ DISTRIBUTOR A
CLIENT ADMINISTRATOR
USER A
USER/ DISTRIBUTOR B
USER C
USER/ DISTRIBUTOR C
USER E
USER B
USER D

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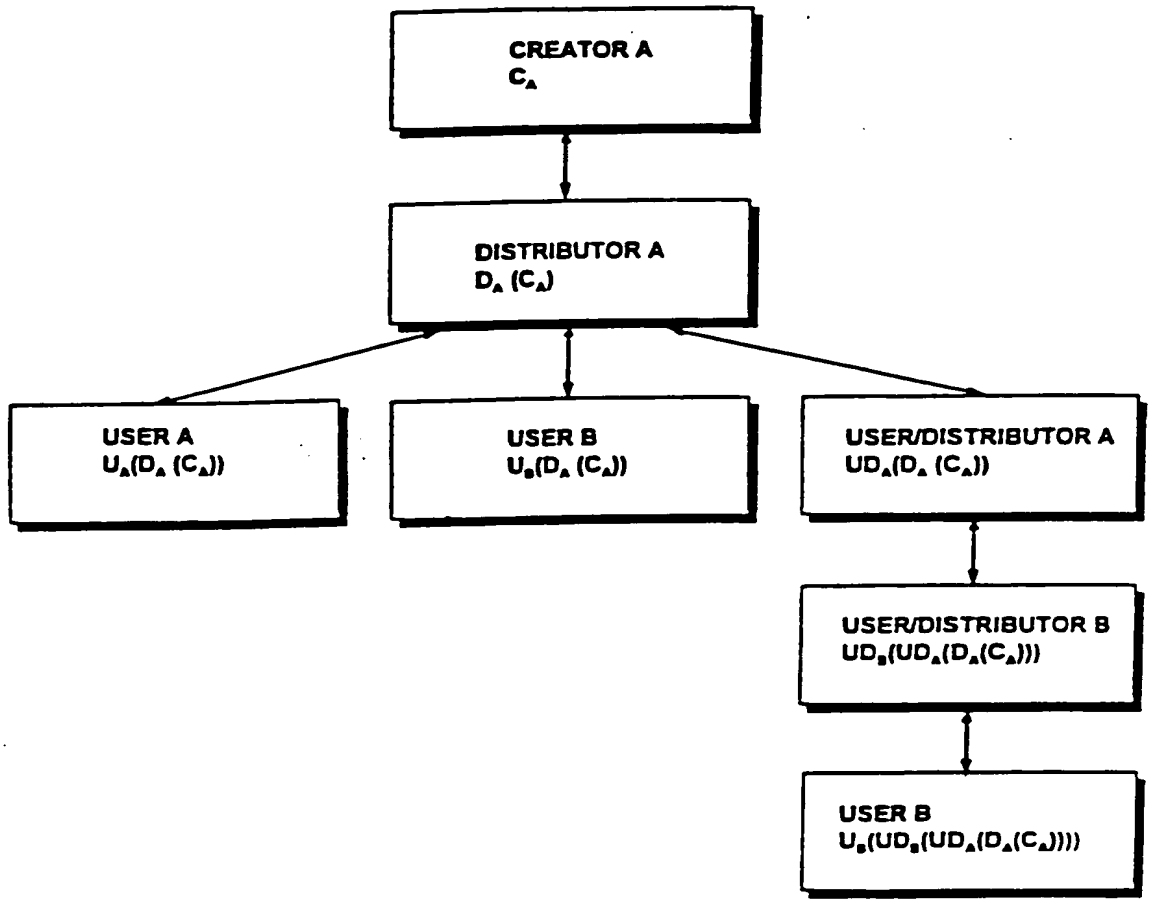
FIG. 80


CREATOR A
C_A
DISTRIBUTOR A
D_A (C_A)
USER A
$U_A(D_A(C_A))$
USER B
$U_B(D_A(C_A))$
USER/DISTRIBUTOR A
$UD_A(D_A(C_A))$
USER/DISTRIBUTOR B
$UD_B(UD_A(D_A(C_A)))$
USER B
$U_B(UD_B(UD_A(D_A(C_A))))$

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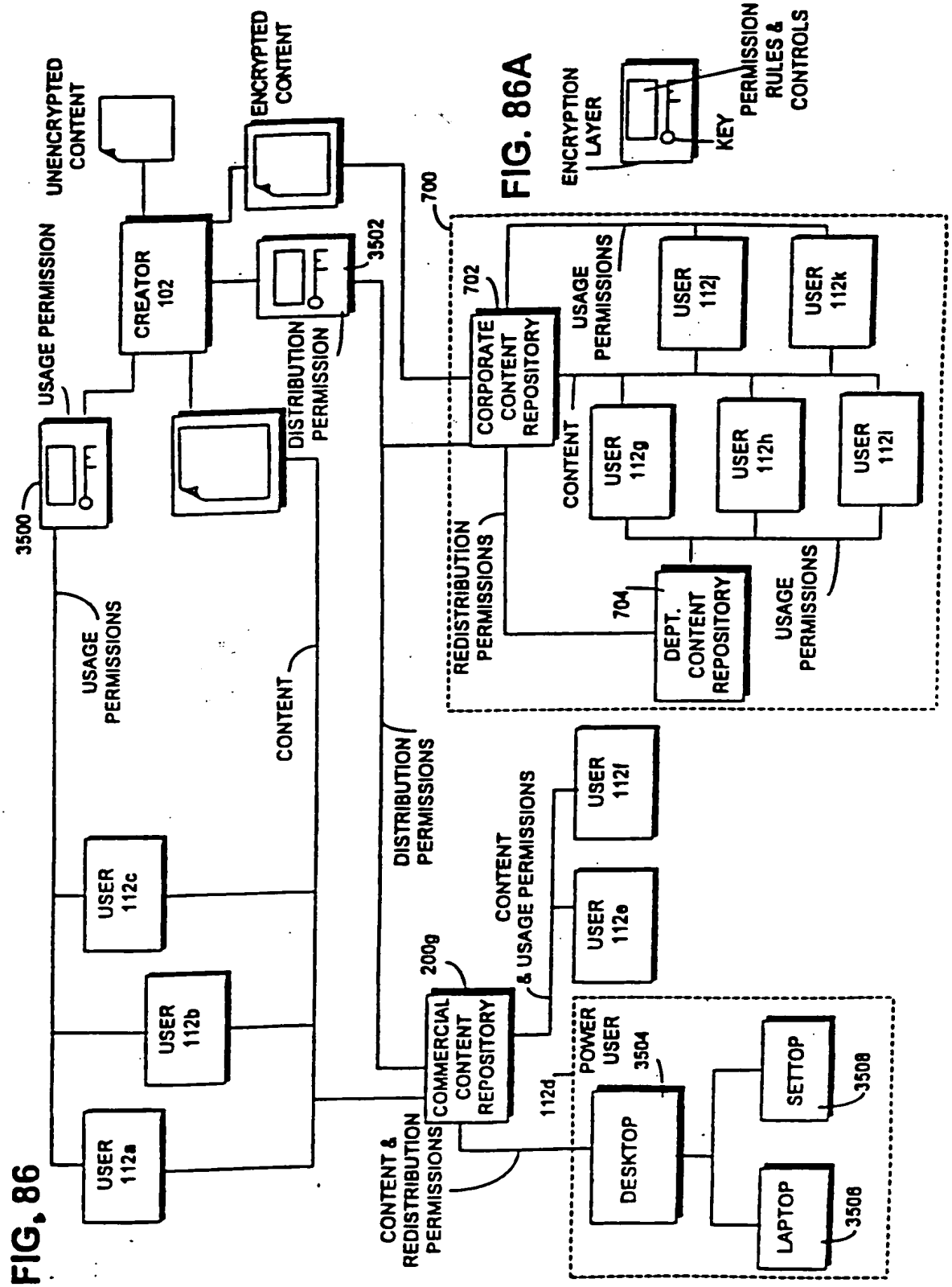

FIG. 86A

FIG. 86

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